WATER RESOURCES

RECOMMENDATIONS

- Watersheds: Foster U.S.-Mexico cooperation on shared rivers and other surface waters, using a watershed approach. Place emphasis on sustainable management, more efficient use of water, conservation, innovative technology, and ecosystem needs.

- Groundwater: Initiate a border-wide groundwater assessment program to systematically analyze priority trans-boundary aquifers. Use this scientific foundation as a springboard for addressing complicated policy issues such as groundwater rights, protection, and competing uses.

- Education, Research: Increase public education to enable border-region residents to actively engage in the protection of their water supplies. Bolster binational research efforts by sharing U.S. technical knowledge and resources with Mexican water agencies and universities to develop comparable data sets that are readily available.

How to effectively manage dwindling, and often impaired, water supplies remains one of the most daunting challenges faced by U.S.-Mexico border communities. This ever more complicated dilemma applies both to surface waters and groundwater. In its last two reports, the Good Neighbor Environmental Board called for handling surface supplies by adopting a watershed approach. In this latest, our Sixth Report, we re-state our call. Moreover, facilitating a watershed approach necessitates addressing gaps in knowledge about groundwater. Finally, we once again recommend that appropriate studies and research be increased to provide adequate data and a body of knowledge on which to make policy decisions. Progress has been made in some arenas during the past year, but some of the most-needed fundamental shifts in policy directions have yet to happen.

SURFACE SUPPLIES

More sustainable management of three trans-boundary rivers – the Colorado, the Rio Grande, and the San Pedro – holds the key to addressing much of the border region's surface water quantity and quality problems. While other important binational rivers such as the Tijuana and New River also must be factored into any policy decision on the region's water resources, the Board has selected the first three as its primary focus for this report.

All three rivers made U.S. media headlines during 2002 due to water competition and drought-related issues. For the Colorado River, attention focused on whether California would be able to reduce its use of surplus water beyond its 1929 allocation on a gradual schedule agreed to by all seven Colorado River Basin states. In the case of the

More sustainable management of three trans-boundary rivers — the Colorado, the Rio Grande, and the San Pedro — holds the key to addressing much of the border region's surface water quantity and quality problems. *Source: U.S. Geological Survey, Austin, Texas.*

Rio Grande, there were impassioned debates on what is called Mexico's "water debt" to the United States and what to do about it. And in the San Pedro River Basin, discussions largely sprang from the need to sustain and enhance an extraordinarily diverse riparian habitat.

The Colorado River is often described as the most controversial and regulated river in the United States. It flows primarily in the U.S., emptying into the Gulf of California in Baja California, 81.4 river miles south of the border. Stretching some 1450 miles, the Colorado River is the nation's fifth longest river, and its drainage basin includes an area of vast and diverse geography, human population, plant and animal species, and politics. Conflicts over water have long been a part of the basin's history. Today, the Colorado River provides water for more than 25 million people, 3 million acres of irrigated land, and 11.5 billion kilowatt-hours of hydroelectric power. Moreover, decisions about the area's water supplies have an impact on 34 Indian reservations.

For the past 100-plus years, users of the Colorado River have been involved in litigation. Multiple agreements establish the framework for managing the river's resources among seven basin states, tribes, and Mexico, and controversies over how these resources are shared remain very much alive. Even while agricultural use of water has remained a priority for the Colorado River Basin states and the U.S. as a whole, a competing demand for water has arisen from the region's increasing urban populations. Consider the growth of cities such as Las Vegas, Phoenix, Los Angeles and San Diego, all of which rely, in part, on Colorado River water.

The modern history of human use of the Colorado River is a story involving enormous change. Prior to damming of its flow, the river fluctuated widely from season to season and from year to year, coming largely from melting snow in the Rockies. Now, a series of major dams tightly controls river flow, and the nature of the river has been completely changed. Reservoirs dot

the landscape, and they trap and remove vast quantities of sediment from the river. The imposed controls on the river are now such that it seldom reaches its original coastal discharge in the Sea of Cortez in northern Baja, Mexico. The actual water needs of the Colorado River delta have never been scientifically determined; rather, the 1922 Colorado River Compact allocates water among compact states and the 1944 treaty determines the allocation of water between the U.S. and Mexico.

Water quality as well as water quantity remains a problem for the Colorado River. Salinity in the Colorado River has fluctuated significantly due to high runoff and flood-control releases, which tend to dilute the concentrations of material dissolved in the river water. Human development and nature contribute about equally to the levels of salinity. Natural sources include saline springs; erosion from saline geologic formations; reservoir evaporation; and riparian plants that consume large quantities of water (phreatophytes), leading to an increase in the concentration of salts. Human sources include irrigation return flow and effluent from municipal and industrial sources. Excessive salinity affects many users and activities: public health, irrigation use and efficiency, municipal and industrial use, wildlife health, tribal water rights, and the quality of water delivered to Mexico.

Salinity concentrations became an international issue as early as 1964, when the Mexican government complained that the water deliveries with salt concentrations of 2,000 parts per million were affecting the farmers' ability to grow crops. To address the concern, in 1974, Mexico and the United States signed International Boundary and Water Commission (IBWC) Minute No. 242, which requires that the United States ensure that Colorado River water arriving at Morelos Dam will have an average annual salinity no more than 115 (+30) parts per million over the average annual salinity of water arriving at Imperial Dam.

The Rio Grande, or Rió Bravo as it is known in Mexico, provides water to some 10 million people, 8 million of whom live in Mexico, and meets irrigation water needs for farmers in Colorado, New Mexico, Texas and Mexico. Along its 1254-mile international boundary, Rio Grande waters are allocated between the United States and Mexico by the Convention of 1906 for the upper 90 miles, and by the 1944 Water Treaty from Fort Quitman – downstream of El Paso-Ciudad Juárez in Hudspeth County – to the Gulf of Mexico. The river provides water for a rich assemblage of wildlife habitats and aquatic species, but this particular function is more and more difficult to sustain as human uses of water drain the river.

Like the Colorado River, the Rio Grande also is highly regulated. Water diversion infrastructure such as surface impoundments (dams) and channelization has greatly altered the river's natural systems. The Rio Grande originates as an alpine stream in the San Luis Valley of Colorado and travels south through New Mexico until it reaches Texas, where it forms the international boundary between the U.S. and Mexico. Its traditional point of discharge is the Gulf of Mexico, 54 river-miles downstream of Brownsville, Texas. But beginning in February 2001, diminished flows in the river, combined with wave action in the Gulf of Mexico, created a sandbar blocking the river's flow from reaching the Gulf. The river finally re-opened naturally in October 2002, when rains in the lower Rio Grande Valley resulted in sufficient flow to re-open its mouth.

Unlike the Colorado River, only 54 percent of the Rió Grande Basin is in the United States, and reservoirs exist in both the United States and Mexico. At Ojinaga, Chihuahua, and Presidio, Texas, the Rió Conchos, which originates in the Sierra Madre mountains of Mexico, joins the Rio Grande. This river has traditionally been the largest contributor of flow into the Rio Grande in Texas. The Rió Conchos contributed an average annual flow of 754,703 acre-feet to the Rio Grande over the period 1968-1997, or 85 percent of the combined historical annual flow. However, IBWC data shows that from 1994 to 2000, the Rió Conchos averaged 142,900 acre-feet, 46 percent of the measured combined flow. This reduction of flow from the Rió Conchos has been due to a persistent drought and to water being retained for Mexican users.

The hydrologic history of the Rio Grande shows a staggering variation in flows, typifying a river that experiences both flooding and drought. Such conditions require an adaptable management approach that accounts fairly for these fluctuations. Yet drought conditions and growing water demands in the border region are testing traditional water-management approaches. At the Law of the Rio Grande conference held in Albuquerque in January 2003, conflicts surrounding ownership, management and control of Rio Grande waters in the three U.S. and four Mexican states of the basin were discussed. Specific issues include disputes over the ownership of water stored in Elephant Butte reservoir, the nature of the Bureau of Reclamation delivery obligations to Texas, potential litigation between Texas and New Mexico, tensions between the city of El Paso and the El Paso County Water Improvement District No.1 (EPCWID) over the price and control of Rio Grande water, the implications of meeting priority tribal rights in times of drought, litigation involving releases of water to maintain wild populations of federally listed endangered species, and the conflict between the U.S. and Mexico involving 1944 Treaty deliveries.

Five stream segments of the Rio Grande have been placed by the Texas Commission on Environmental Quality (TCEQ) on the Clean Water Act 303(d) list of impaired bodies, primarily for bacteria and dissolved solids. While sewage treatment plants are well regulated in the U.S., many Mexican municipalities along the river have inadequate sewage systems. That being said, a number of plants have recently been constructed or are planned for a number of Mexican towns along the river.

The third river covered in this report, the San Pedro River, originates in the Mexican state of Sonora approximately 20 miles

south of the border and flows north into the United States. It is one of the last free-flowing rivers in the Southwest, and is one of only a few desert rivers that flow north into the United States. Approximately 28 percent of the basin lies in Mexico and is under solely Mexican jurisdiction.

The San Pedro supports a narrow corridor of riparian vegetation that is habitat for 400 birds, 84 mammals, and 47 amphibian and reptile species, as well as 14 fish species. Several of these species are designated as endangered. A 1998 study of riparian migratory bird habitat completed for the North American Commission for Environmental Cooperation (CEC) highlighted the unique ecological features of the San Pedro, especially as a migratory corridor providing an oasis in the desert for species traveling from north to south and back. Literature suggests that as many as 4 million songbirds fly through the San Pedro basin between wintering grounds in Mexico and Central America, and their summer breeding grounds in the United States.

Fortunately, the river's critical role as wildlife habitat already has received some recognition. The Nature Conservancy has declared this region as one of the 12 "Last Great Places" in the Western Hemisphere, and both the American Bird Conservancy and the CEC have officially recognized the area as an "Important Bird Area." In 1988, Congress designated almost 48,000 acres as a Riparian National Conservation Area (RNCA).

Now, however, the San Pedro is at risk due to increasing demand for water in Sierra Vista, Arizona, by a rapidly expanding population. Yet to maintain the many types of biotic communities that compose the Upper San Pedro's unique ecosystem, it is necessary to maintain flow in the River at all times, even during prolonged dry periods. Here again, competing uses for limited supplies has become a thorny dilemma with no easy solution.

GROUNDWATER SUPPLIES

Some of the same challenges faced by users of the Colorado, the Rio Grande, the San Pedro, and other surface-water resources in the border region also affect users of water supplies that lie underground. But there are additional issues as well. Groundwater supplies within the border region are contained in vast binational basins that span the international boundary. Many of these border-region aquifers are located in a very complex hydrologic setting. In many cases, little is known about the availability, sustainability and quality of these supplies, or how they interact with surface-water bodies. Knowledge also is lacking about characteristics such as depletion rates, recharge rates, level of use, level of conservation, and the impact of drought. Yet, the need to fully assess these trans-boundary aquifers is becoming more critical due to droughts, rapid population growth, and limited surface-water supplies.

Under Mexico's constitution and national water law, groundwater is a national resource, whereas in the United States, groundwater management and regulation largely are functions of state laws and court rulings. Both nations currently abide by a number of treaties and binational agreements dealing with international boundary water issues. However, a specific agreement on groundwater management and allocation between the U.S. and Mexico does not exist. And in some sense, at this point in time, such an agreement could be seen as premature until more is known about the resource in question.

Some basic research has been carried out by the IBWC, the U.S. Geological Survey (USGS), and New Mexico State University on a select few trans-boundary aquifers. However, there are approximately 18 critical trans-boundary aquifers along the border, and for most of them data remain fragmentary at best.

POLICY ISSUES, PARTNERSHIPS, AND NEXT STEPS

Based on developments in water resources management activities during 2002, the Good Neighbor Environmental Board has identified several key policy issues and next steps it advises be taken to address these issues. Examples of effective partnerships also are included:

Issue 1

DISPUTE INVOLVING TREATY DELIVERIES. Dispute involving water ownership and treaty deliveries continues to dominate water management for both the Colorado and Rio Grande rivers. For the Rio Grande, the United States and Mexico continued their discussions during 2002 on the delivery by Mexico of waters obligated under existing agreements. These discussions resulted in development of Minute No. 308 (*see box on page 7*), which calls for both immediate and long-term actions for the efficient use of waters in the Rio Grande Basin. The two governments continue to have high-level discussions to develop measures necessary for achieving a fundamental and lasting solution to this very complicated and highly charged issue.

For the Colorado River, interstate compacts, international treaties including the same 1944 Water Treaty that applies to the Rio Grande (*see box on 1944 Treaty*), Congressional acts, and Supreme Court decrees – all collectively known as the "Law of the River" – govern the river's management activities. Allocation of its waters with the U.S. is governed by the Colorado River Compact (1922), negotiated by the seven basin states and the U.S. government. The Compact recognizes the need to divide the use of the Colorado River between the upper basin states (Colorado, New Mexico, Utah, Wyoming, and portions of Arizona) and the lower basin states (*California, Nevada, and a large portion of Arizona*), apportioning each the use of 7.5 million acre-feet per year.

The 1944 Treaty

The United States and Mexico entrust to the International Boundary and Water Commission (IBWC) the application of various boundary and water treaties and the settlement of any differences that arise. One of the most significant treaties is the Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande. Signed on February 3, 1944, this agreement is commonly referred to as the "1944 Water Treaty." An earlier treaty, the Convention of 1906, provides for the delivery of waters to Mexico in the El Paso-Ciudad Juárez valley.

To carry out its responsibilities, the IBWC applies the provisions of a treaty through agreements called Minutes. An IBWC Minute establishes the legal basis for a binational project, further defines the funding source, and describes the binational approach for project development. The Minute is executed by the Commissioners and Secretaries of both sections of the IBWC. Minutes are approved by the U.S. State Department and its Mexican counterpart, the Foreign Relations Secretariat (SRE). Once approved, a Minute forms a binding obligation between the two governments.

Under the portion of the 1944 Water Treaty that governs trans-boundary allocation of Rio Grande surface waters, Mexico is to deliver a total of 350,000 acre-feet per year, from six Mexican tributaries, averaged over a five-year cycle, to the United States. Mexico fell behind on its obligation in the 1992-1997 accounting cycle and owed 1.02 million acre-feet at that time. During the subsequent cycle, from 1997 to 2002, Mexico fell further behind, and as of the end of 2002 owed a total of about 1.5 million acre-feet to the U.S.

Farmers in the Lower Rio Grande Valley of Texas use the majority of this water, and they, along with elected officials in Texas, have repeatedly called for resolution of the deficit. At the close of the latest accounting cycle, which ended October 2, 2002, the U.S. State Department issued a statement on the matter that called for "meaningful and rapid steps by Mexico" in resolving its treaty obligations. The Texas Commission on Environmental Quality, on October 30, 2002, released a statement outlining the state's position on the 1944 Water Treaty. In essence, the view of Texas was that Mexico was in material breach of the 1944 Water Treaty and outlined measures the U.S. could take for legal remedy against Mexico such as providing water out of non-tributary treaties. The U.S. and Mexico continue to seek resolution to the water-debt issue through active negotiations.

The 1944 Water Treaty requires the United States to deliver 1.5 million acre-feet to Mexico per year from the Colorado River, plus an additional 200,000 acre-feet in times of surplus. In recent years, California has consistently diverted and used more than its 4.4 million acre-feet apportionment; Nevada is close to diverting its full share, and Arizona is diverting its entire allocation.

For all three rivers – the Rio Grande, Colorado and San Pedro – dwindling water supplies are prompting other conflicts as well. For instance, the stretch of the Rio Grande running from the Texas state line to where the 1944 Water Treaty jurisdiction begins at Fort Quitman is cycled through the city of El Paso and two irrigation districts, all of which are trying to meet water delivery needs. The city of El Paso, which receives water from EPCWID, argues that EPCWID is charging too much and has asked the state to intervene. Whether this water should be governed by the federal government because it originates at Elephant Butte Reservoir, which is managed by the Bureau of Reclamation, or whether the state of Texas has jurisdiction on this issue is a matter of opinion. New Mexico, Texas and the federal government all are seeking to determine the answer.

An historic moment: Mexican Ambassador F. Castillo Najera signs the1944 Water Treaty in Washington, D.C., February 3, 1944. Seated at the table, left to right: Mexican Commissioner Rafael Fernandez MacGregor, Mexican Ambassador F. Castillo Najera, Secretary of State Cordell Hull, American Ambassador to Mexico George S. Messersmith, and U.S. Commissioner Lawrence M. Lawson. *Source: IBWC Archives.*

In the San Pedro River basin, the rapidly growing population and accompanying incremental demand on groundwater is in direct conflict with the need for a sustainable water supply to maintain the ecosystem that is protected within the RNCA. Economic and ecological values converge dramatically along the San Pedro River, and the community faces a complex challenge in balancing these needs.

Next Step

INCREASE VOLUNTARY BINATIONAL COOPERATION USING A WATERSHED APPROACH, SUPPORT CONSERVATION MEASURES. Scarcity of surface supplies, combined with a different interpretation of certain treaty provisions, means that voluntary partnerships within shared watersheds are essential for managing these supplies. Moreover, decisions concerning management of surface-water supplies must be founded on consistent data that are acceptable both regionally and binationally.

The Good Neighbor Environmental Board notes that on a number of levels, particularly in Minutes 307 and 308 of the 1944 Treaty, both the U.S. and Mexico have declared their commitment to effective binational management of the Rio Grande Basin. In the view of the Board, it is especially critical now for both the U.S. and Mexico to step back and reassess current water-management scenarios. This reassessment should include an examination of reservoir operations, allocation priorities, water measurement, water quality and system controls. Both governments must direct sufficient financial, human and political resources toward ensuring that these commitments are met in the very short term so that sound management practices can be put into place and maintained.

In the United States, discussions are under way to establish a Federal Watershed Coordinating Committee for the Rio Grande River watershed. The purpose of this committee is to facilitate regular information exchange and collaboration among federal agencies to prevent duplication of effort and more efficiently utilize existing resources.

Partnering across existing organizations at other levels of government also can yield real benefits. For instance, border states should support access to the resources of border cities, or state-wide organizations with interests in Mexico. Case in point: The state of California established a cooperative relationship with the City of San Diego Metropolitan Wastewater Department related to industrial wastewater program development in Baja California. In addition, California State University, Sacramento, has been funded by U.S. Environmental Protection Agency (EPA) and the state of California to develop water and wastewater training materials for use in Baja California. And the Association of California Water Agencies has implemented a "Hands Across the Border" program through which its member agencies will provide technical resources to Baja California water utilities. Professional organizations such as the Water Environment Federation could be encouraged or assisted to provide translation services at conferences and meetings.

Concurrently, conservation efforts must continue to be a cornerstone of more efficient water use throughout the border region. Recent mandate expansion agreements for the Border Environment Cooperation Commission (BECC) and the North American Development Bank (NADBank) have paved the way for projects that result in water conservation to receive NADBank funding (*see Special Topics section, BECC-NADBank Reform*). At a special meeting of the Board of Directors from BECC, held on October 17, 2002, the Board unanimously certified its first water conservation project. The project will entail modernization and technical improvement for irrigation district 005, in Delicias, Chihuahua. This district is considered the most important of the three irrigation districts located in the Rió Conchos sub-basin. Expected increased efficiency will reduce losses by 50 percent, according to BECC. Savings from projects such as these are expected to be applied to Mexico's current water debt.

The Board advises that BECC funds directed toward water conservation continue to be directed toward where they are needed most within the framework of Minute 308 and where this need has been well documented. Disbursement of funds should be tied to clear commitments from recipients in the form of stated water savings. Close monitoring of such projects might include installing real-time stream-flow gauges and meters, sharing resulting data via web transmission with the public to increase transparency and promote public involvement in policy development.

Issue 2

COMPLEXITIES OF TRIBAL WATER RIGHTS: Native American groups have multiple interests in both the Rio Grande and Colorado River basins. Water development is important for tribal economic development on reservations. Conversely, tribes also support the establishment and protection of in-stream flows to protect fish and wildlife resources.

An already complicated scenario along the border is further complicated because the officially recognized status of tribes in the United States and in Mexico differs. The United States recognizes that U.S. tribes are separate sovereign governments, and that equity issues affecting tribal governments must be addressed in the United States on a government-to-government basis. By contrast, Mexico recognizes the historical debt it has with its indigenous communities and has said it will consider appropriate measures to address their particular concerns as well as protect and preserve their cultural integrity.

In the United States, for the most part, the specific rights of tribes as sovereign governments have not been verified and quantified by a court. Indian rights, if fully realized, could have a significant effect on water rights established under state law. Most western states follow what is called the prior appropriation (first-in-time, first-in-right) and beneficial-use doctrine (water must be used for a beneficial use). In 1908, a court case established the concept that Indian tribes are the senior rights holders in a basin (having resided there since "time immemorial") and are exempted from the "beneficial use" clause generally required of water users by state law. Though the

potential exists, therefore, for tribes to claim their water rights, many have not done so to date. One of the main barriers is that most tribal water rights, in order to be adjudicated, must go through a General Stream Adjudication (GSA) process through which rights are recognized by both the states and the federal government. This process takes many years, is extremely expensive, and may be politically divisive. Many tribes are not fully prepared to adjudicate their water claims because they lack the funds to assess, plan and develop their rights. Moreover, the U.S. government does not have the obligation to develop tribal water resources.

Of note, at the January 2003 Law of the Rio Grande conference (mentioned above), the Isleta Pueblo in New Mexico reasserted their "prior and paramount" rights to Rio Grande water stored in El Vado reservoir and to certain deliveries made in the Middle Rio Grande Conservancy District. This is a position of the six Middle Rio Grande Indian pueblos (Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia and Isleta), which hold "prior and paramount" water rights collectively. The pueblos may have negotiated successfully with the Department of Interior and Bureau of Reclamation to ensure adequate storage of water in El Vado reservoir to make deliveries for the 2003 irrigation season, even as the Bureau predicts dire water shortages in 2003 deliveries due to low snowmelt. In this case, and in the silvery minnow case (*Rio Grande Silvery Minnow v. Keys*), the pueblos have asserted that because of the nature of their water rights, they are not subject to curtailment.

In addition, the Santa Ana Pueblo of New Mexico has successfully raised the funds for an extensive restoration project on its section of the Rio Grande River above Albuquerque. The project includes removal of redundant and ineffective bank stabilization structures that have prohibited natural river movement, the removal of salt cedar and other invasive non-indigenous flora, and the restoration of native vegetation and cottonwood bosque on approximately 1200 acres of riparian lands along 6.5 miles of the river.

For the Colorado River, the San Luis Rey Band of Mission Indians was given an allocation of 64,000 acre-feet/year in the Quantification Settlement Agreement that was to have been signed on December 30, 2002, by parties using Colorado River water in California. Colorado River Indian tribes continue to work to have their water rights adjudicated.

Next Step

PROMOTE FULL TRIBAL INVOLVEMENT IN WATER-MANAGEMENT DISCUSSIONS. Because of the importance of the resource to their development, and given their rights, tribes should be enabled to fully participate in border-region water-management discussions. In addition, tribes should be supported in undertaking restoration projects, bearing in mind that they may theoretically qualify for federal funding through grant programs but often lack the matching funds necessary to obtain such a grant.

Minute 308

Minute 308, signed June 28, 2002, recommended establishing funding for water conservation projects and irrigation infrastructure improvements in both the U.S. and Mexico through the North American Development Bank (NADBank) and the Border Environment Cooperation Commission (BECC). These institutions, under an expanded mandate, have liberated $80 million in interest on paid-in capital for the Water Conservation Investment Fund (WCIF), which will provide grant monies for such projects. Projects in Mexico receiving funds are subject to agreement within the International Boundary and Water Commission (IBWC) regarding surface-water flows that must be provided to the U.S. as a result of the water infrastructure improvements. As of the end of 2002, the NADBank was refining its guidelines for submitting projects to be funded through the WCIF.

Issue 3

CONTINUED DROUGHT. The seasonal U.S. drought outlook is not encouraging. According to some long-term projections, a slow improvement is likely in the Lower Rio Grande Valley border region. Yet according to a forecast by the Bureau of Reclamation, for the first time in more than 30 years the Rio Grande upstream from Fort Quitman, Texas, will experience drought conditions in 2003; if this scenario comes to pass, it could add to problems being experienced further south in the Rio Grande Basin. Meanwhile, for the Arizona, New Mexico and California portion of the border, the forecast is for persistent drought.

A number of current water supply and management practices were instituted when trans-boundary surface-water supplies still were relatively plentiful. Drought can test the limits of existing practices and often reveal their weaknesses, particularly a lack of longer-term thinking.

Next Step

INSTITUTIONALIZE DROUGHT-MANAGEMENT PLANS. A pressing need exists for drought-management plans that would supplement existing water management agreements. These plans must incorporate ecosystem needs within the mix of "user" needs to be satisfied. Dialogue among all parties at all levels across both countries is essential to such agreements.

During 2002, the IBWC took a step in this direction through its passage of Minute No. 308 (see box). The language

Non-native aquatic plants continue to challenge natural resource managers in the Rio Grand basin. This invasive shrub, called *salt cedar*, was photographed in May 2002 in Big Bend National Park, Texas. *Photo credit: Sarah L. Wynn, Research Botanist, U.S. Bureau of Reclamation*

in this document signals the intent of the Commission to form a technical committee for the exchange of information related to drought management. Minute 308 considered recommendations made in Minute 307 regarding both a binational summit of experts and the formation of an International Advisory Council to act as a forum for the exchange of information and advice to IBWC regarding sustainable management of the Rio Grande Basin. The Good Neighbor Environmental Board fully supports implementation of these recommendations. It is extremely important to maintain the focus on sustainable management of these waters, particularly as growth and drought continue to test the limits of existing international agreements.

Border states have the potential to play a key role in developing strategic approaches to drought management. For instance, the Texas Water Monitoring Council and the Texas Drought Preparedness Council will sponsor a working technical conference during 2003 to develop information to assist state-level managers in reporting and drought preparedness measures. Results from this symposium should be closely followed in light of potential best practices elsewhere and for their potential binational relevance.

Issue 4

ECOSYSTEM DEGRADATION. The endangered Rio Grande silvery minnow is now confined to a small stretch of the river below Cochiti Dam and above Elephant Butte. Environmental groups are engaged in pressing for appropriately timed releases of water to maintain a flow sufficient for the survival of the minnow, but some water users – particularly municipal and irrigation interests in the Albuquerque region – are opposed to releasing flows for the minnow.

Non-native aquatic plants, including an invasive shrub called salt cedar, continue to challenge natural-resource managers in the Rio Grande Basin. Not only does it consume tremendous water supplies, it prevents native species of riparian and wetland vegetation (cottonwood, willow and mesquite) from reestablishing in areas where flood flows have been eliminated, forming a monoculture and "taking over" long swaths of riverfront habitat. Other problems salt cedar can create include increased salination of riparian soils; diminishing wildlife and habitat diversity; and clogging the channel of rivers, irrigation ditches, seeps and springs so that flows are impeded, thus diminishing the quality of riparian lands.

A variety of contaminants also continues to threaten the region's water resources and the ecosystems that depend on them. For instance, some 152 miles of the Rio Grande in New Mexico have been categorized as impaired, meaning they do not fully meet their designated water-quality uses according to Clean Water Act criteria stipulated in Section 303(d). And throughout much of its reach in Texas, according to the 2002 draft 303(d) list, the Rio Grande is impaired by bacteria, chlorides (salts), total dissolved solids, and ambient toxicity.

The Salton Sea, a geologic component of the Colorado River Basin, is sustained by agricultural, domestic and industrial wastewater from the Mexicali Valley in Baja California and the Imperial Valley and Coachella Valley in California. It is a key component of the Pacific Flyway, and is visited by more bird species than any other place in the U.S., except for the south Texas coast. The Salton Sea supports a major sport fishery and is a significant recreational resource in Southern California. Because the sea is a closed basin, its size and salinity are directly related to the amount of inflow. Salinity levels, which are already considered to be critically high, will rapidly increase, and the existing ecosystem food chain will collapse if inflows are reduced.

Next Steps

SUPPORT COMMUNITY-LEVEL EFFORTS TO PROTECT ECOSYSTEMS. Recently, efforts have focused on finding ways to eliminate salt cedar from the banks of Western rivers where it has gained a strong foothold. An extensive eradication effort involving the use of herbicides on the Pecos River has met with some success, but there is still a need for planning and implementation of more holistic restoration/enhancement strategies for all river basins affected by invasive species.

The binational Rio Grande/Bravo Ecosystem Working Group (BREW), administered by the IBWC and involving state, federal and NGO members, has been pursuing collaborative binational salt cedar control pilot projects, primarily on federal land adjacent to the Big Bend region in Texas. Expanding this specific effort to a larger-scale endeavor offers great potential and likely would receive support from a wide range of agencies, landowners and organizations. Among the many, often

contentious, issues facing the Rio Grande, an effort to reduce salt cedar infestation and enhance the riparian zone could provide immediate benefits and also be a stepping stone to addressing more divisive topics.

In a related initiative, the Agricultural Research Service of the U.S. Department of Agriculture is proceeding with plans to release the Chinese Leaf Beetle for biological control of salt cedar at selected locations in the Rio Grande River watershed, including locations on the U.S.-Mexico border. The start of this research is contingent on Mexican agreement to release sites near the border and assurances of funding for follow-up monitoring.

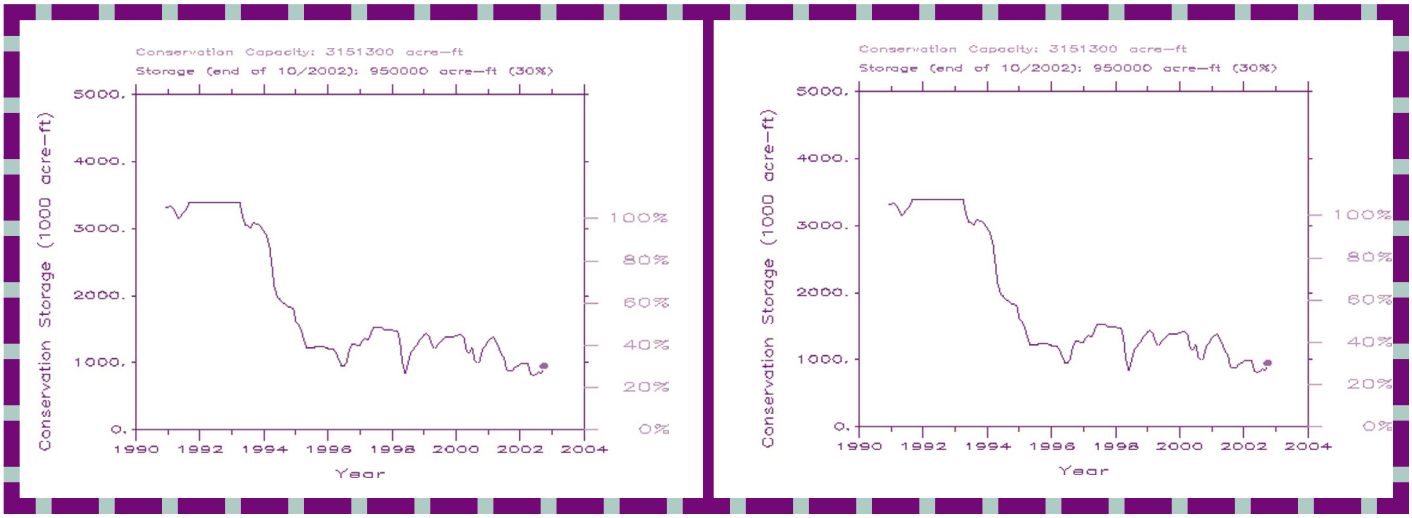
INCORPORATE ECOSYSTEM NEEDS FOR WATER IN ALL DECISION-MAKING AND IN MARKET INCENTIVES. While existing treaties and water-management agreements recognize the water needs of different user groups, at the time they were written, these agreements did not take into account the needs of the fish and wildlife that the river systems support. These needs should be accounted for in all decision-making now and in the future, and must be given equal weight when considering how water should be allocated. In addition, a number of tools exist that could provide incentives for water to be "freed up" for the environment, such as forbearance contracts (farmers are paid NOT to irrigate, particularly on marginal land), water trusts (allowing for water to be "deposited" at a tax advantage to the water right owner and avoiding cancellation for non-use), and outright purchase of available water rights.

RECOGNIZE INSTREAM FLOW AS A WATER-QUALITY VALUE. Increasing flows in rivers and streams helps lower salinity levels, dilute toxins and increase overall water quality. There are programs in place to identify and mitigate the effects of toxins (such as the Total Maximum Daily Load program implemented at the state level). These programs, while important, take many years and millions of dollars to implement. Purchasing available water for instream flows might in time also improve water quality in select areas.

Issue 5

LACK OF KNOWLEDGE ABOUT GROUNDWATER RESOURCES. Instituting a strategy to share the region's groundwater resources first requires a level of knowledge about their characteristics and availability, knowledge that currently is lacking. Without sound binational studies of trans-boundary aquifers, uncertainty about groundwater resources will only continue. Most of the aquifer systems have very complex hydrology, which creates a barrier to understanding how these border groundwater supplies function. More information is needed on groundwater quality, quantity, depletion rate, conservation, recharge, withdrawal, drought and usages.

Aside from the need for additional basic research, there also is a need to gather and disseminate best management practices. Interestingly, Mexico and the United States did agree in 1973 through Minute 242 to limit specific volumes of groundwater



Drought conditions in the Rio Grande Basin are testing traditional water management practices. Amistad International Reservoir, located on the Rio Grande/Rió Bravo near Del Rio, Texas and Ciudad Acuna, Mexico, was at about 30 percent of its capacity at the end of October 2002. Falcon International Reservoir, located on the Rio Grande/Rió Bravo near Zapata, Texas and Nueva Ciudad Guerrero, Mexico, was at about 25 percent capacity at the end of October 2002. Updates available at:
http://www.twdb.state.tx.us/publications/reports/waterconditions/conservationstorage/conservation_storage.htm
Source: Texas Water Development Board.

that could be pumped by each country within 8 kilometers of the Arizona-Sonora international boundary. This agreement called for additional consultation on actions that might adversely affect the other country.

Next Step

BUILD TRUST, BUILD ON PROGRESS TO DATE. Building trust is a key precursor for engaging in informed negotiations regarding shared trans-boundary groundwater resources. This effort should involve binational data collection, transparency, and a commitment to maintain a robust database concerning the interaction between ground- and surface-water resources. But besides filling these scientific, institutional and legal information gaps, other critical matters such as capacity building, raising awareness, and possible investment potential have to be addressed.

Water-management agencies in both the U.S. and Mexico undertook to construct an extensive database concerning shared groundwater resources in the El Paso-Ciudad Juárez region that was completed in January 1998. Following this example of a collaborative effort, the two governments and appropriate state agencies can undertake similar studies in other population centers along the border, prioritizing the areas of greatest need based on population and water-use projections.

On a global level, efforts are under way in Europe, Africa, and South America to develop effective management practices for internationally shared aquifers. Several international organizations have developed a project titled "International Initiative on Shared Aquifers" (ISARM), whose mission is to champion best practices for the management of groundwater resources shared between neighboring countries. The ISARM project aims to develop methods and techniques for improving the understanding of aquifers and the management of shared groundwater systems, bearing in mind both the technical and the institutional dimensions.

In the view of the Good Neighbor Environmental Board, the ISARM process has merit. Furthermore, it may be wise for U.S. and Mexican agencies to enter into the dialogue, placing the Hueco Bolson and other important trans-boundary U.S.-Mexico aquifers on ISARM's inventory of internationally shared aquifers. Water-resource managers from the border region could both learn from and contribute to the dialogue.

Another potentially promising development: In response to a request from Congress, the USGS, Sandia National Laboratory, and the Water Resource Research Institutes in all four U.S. border states have prepared a joint concept proposal for a binational program to assess trans-boundary groundwater resources in the border region. This long-term study, if funded, would begin in 2004.

Issue 6

OVER-PUMPING OF GROUNDWATER SUPPLIES, DISCONNECT WITH SURFACE SUPPLIES. Some groundwater supplies that *have* been identified are in danger of depletion. One example is the Hueco Bolson, the major trans-boundary aquifer in the El Paso-Ciudad Juárez area of the border region. In 1999, a total of 191,000 acre-feet were pumped from the Hueco Bolson, 63 percent by Mexico. The recharge rate is estimated to be only about 6,000 acre-feet, and much less than that during periods of prolonged drought. As pumping continues to increase due to the anticipated population growth on both sides of the border, the Hueco Bolson in Ciudad Juárez, Mexico, will become unusable without treatment due to total dissolved solids concentrations above acceptable standards. A USGS study estimated that by 2005, water levels in the aquifer will drop to a level that creates conditions for saline water to enter and contaminate it, resulting in degraded water quality in public supply wells in Ciudad Juárez. El Paso faces a similar situation, although it is projected to run out of groundwater by 2020 and is investigating a variety of alternatives, including desalination.

Moreover, traditional management approaches to the border's water resources have not been based on the premise that surface water and groundwater are a single resource. Yet, the development of either of these resources profoundly affects the quantity and quality of the other. Because the hydraulic connection between surface- and groundwater often is difficult to observe and measure, this interdependence has been all too easy to ignore in water management considerations and policies.

Unfortunately, this disconnect is graphically illustrated by conditions in the San Pedro River Basin. Pumping of underground supplies in the basin to irrigate agriculture, supply private water companies, and supply domestic wells has an effect on ecosystem dynamics within the San Pedro RNCA above ground. When the base flow of the river is changed, so is the riparian habitat. Despite recommendations from area natural-resource managers that a certain level of flow be maintained throughout the perennial reaches of the upper San Pedro, growth in the nearby communities of Sierra Vista and Fort Huachuca continue to draw upon groundwater supplies and hence threaten the conservation area.

Next Step

ENCOURAGE BINATIONAL PLANNING TO PREVENT GROUNDWATER DEPLETION, INTEGRATED APPROACH TO MANAGING SURFACE AND UNDERGROUND SUPPLIES. Strategic binational planning is needed to avoid over-pumping and to balance production, recharge and salinity of groundwater supplies. This balance should be achieved through joint development of a binational agreement that ensures one community's water reductions not be offset by the other's

overuse. The El Paso-Ciudad Juárez area is one of the few binational locations in which there are numerical models that can be used to evaluate a number of water optimization strategies. Moving ahead in this area could provide impetus and practical outcomes to guide efforts elsewhere.

To better protect and manage both surface- and groundwater supplies, water policy makers at all levels of government on both sides of the border should foster an integrated approach that is based on the premise that these supplies essentially are a single, interconnected resource.